

CLAIMS

1. A modular submersible repairing system comprising:
a working unit; and
a base unit;

wherein the working unit includes:

at least one type of tool module repairing structures in a reactor,

a scanning/pitching module being selectively connected to or disconnected from the tool module, and provided with a scanning/pitching shaft for scanning or pitching the tool module,

a submersible fan module being selectively connected to or disconnected from the scanning/pitching module, and

a first buoyant module for keeping an orientation of the tool module;

the base unit includes:

a manipulator module internally provided with an actuator driving mechanism,

a adsorbing module being detachably mounted on the manipulator module and of adsorbing to a wall, and

a second buoyant module for keeping an orientation of the manipulator module;

each of at least the scanning/pitching module and the manipulator module is provided with a submersible connecting device being operated in water for engagement and disengagement;

configuration and functions of the modular submersible repairing system can be changed or modified according to various purposes of work in the reactor by properly combining those modules; and

the modules can be connected together in the reactor by remotely operating the submersible connecting devices.

2. The modular submersible repairing system according to claim 1, wherein the submersible connecting device includes a male connecting unit provided with a taper member, and a female connecting unit provided with a taper hole complementary to the taper member.

3. The modular submersible repairing system according to claim 2, wherein the submersible connecting device is provided with an ultrasonic distance measuring device measuring distance between the modules to be connected in a noncontact measuring mode, and a locking mechanism for preventing disengagement of the male connecting unit and the female connecting unit.

4. The modular submersible repairing system according to claim 1 further including a hoisting device for suspending and submerging a desired module in water, comprising a gripper for gripping the module, and a submersible connecting device engaging/disengaging device drawing a first module to be connected to a second module toward the second module and of pushing the first module away from the second module.

5. The modular submersible repairing system according to claim 4, wherein the submersible connecting device engaging/disengaging device includes an axially movable arm, and a claw which engages the first module to draw the first module toward the second module or to push the first module away from the second module.

6. The modular submersible repairing system according to claim 1, wherein the manipulator module is provided with an extension mechanism which is expandable, and the scanning/pitching module is connected to an extremity of the extension mechanism.

7. A repairing method using a modular submersible repairing system, said method comprising the steps of:

building a base unit by connecting a adsorbing module provided with vacuum suction cups, and a submersible fan module for generating a thrust to upper and lower ends of a manipulator module, respectively, and attaching a buoyant module to an upper end of an assembly of those modules;

building a working unit by assembling a scanning/pitching module scanning and pitching operations, a submersible fan module, a buoyant module and a tool module;

building a modular submersible repairing system by assembling the base unit and the working unit by connecting the scanning/pitching module to the extension mechanism of the

manipulator module;

suspending the modular submersible repairing system in an annular space between a shroud and a pressure vessel of a nuclear reactor;

pressing the base unit against a surface of the shroud by operating the submersible fan module and fixedly holding the base unit on the surface of the shroud by the suction cups of the adsorbing module;

pressing the working unit against the surface of the shroud by the agency of the submersible fan module, and operating the extension mechanism of the manipulator module in a remote control mode to move the scanning/pitching module laterally along the surface of the shroud and to locate the scanning/pitching module; and

operating the tool module for scanning and repairing by the scanning/pitching module.

8. A repairing method using a modular submersible repairing system, said method comprising the steps of:

installing a fixing module and a height adjusting module on a control rod guide pipe and a core plate, and mounting a manipulator module on the height adjusting module;

holding a scanning/pitching module combined with a submersible fan module, a buoyant module and a tool module by a hoist device, and suspending the scanning/pitching module through a passage other than that through which the manipulator module has been carried onto the height adjusting module;

connecting the scanning/pitching module to an extension mechanism included in the manipulator module by a remotely controlled operation;

disconnecting the hoisting device from the scanning/pitching module, operating the manipulator module to move the tool module connected to the scanning/pitching module near to an objective part to be repaired, and locating the tool module by the agency of the submersible fan module; and

driving the tool module for scanning and repairing work by the scanning/pitching module.